W91321-04-C-0023

LOGANEnergy Corp.

Marine Corps Base Kaneohe, Hawaii
PEM Demonstration Program,
Final Report

Proton Exchange Membrane (PEM) Fuel Cell Demonstration
Of Domestically Produced PEM Fuel Cells in Military Facilities

US Army Corps of Engineers
Engineer Research and Development Center
Construction Engineering Research Laboratory
Broad Agency Announcement CERL-BAA-FY03

Residence of
Marine Corps Major James Bain
MCB Kaneohe Bay, HI

October 11, 2006

Executive Summary

Under terms of its FY'03 DOD PEM Demonstration Contract with ERDC/CERL, LOGANEnergy has installed one Plug Power GenSys 5kWe Combined Heat and Power fuel cell power plant at MCBH Kaneohe Bay, Hawaii. The unit operates at the base housing quarters of Marine Corps Major James Bain.

This project had its genesis with LOGAN's original submittal in the CERL BAA FY'01 PEM Demonstration Program. Since natural gas is not available in Hawaii, the site had to be withdrawn once it became clear that product manufacturers would not be able to deliver a reliable LPGas fuel cell for the project. Then in the summer of 2002, when the first LPGas PEM systems became available, LOGAN decided to reapply for the Hawaii site. After determining that the base still supported the initiative, LOGAN resubmitted the Kaneohe proposal in June 2003. The project kick-off meeting occurred on Oct 14, 2004 and two months later the first start occurred on Dec 14, 2004.

The Combined Heat and Power (CHP) installation operates electrically in a grid parallel/grid independent configuration that ties several kitchen appliances and convenience outlets onto the fuel cell's critical load panel. The unit's waste heat output was captured by the residential hot water heater. The installation is instrumented with an external wattmeter, BTU meter, thermometer and a gas flow meter. A phone line is connected to the power plant communication's modem to call-out with alarms or events requiring service and attention. In addition, this site has a web-enabled Supervisory Control and Data Acquisition (SCADA) system that provides real time operational control, management and alarming.

The official site acceptance test occurred on March 1, 2005 and was enthusiastically attended by members of the base environmental and civil engineering staff. The unit performed normally during the test and the site inspection confirmed the installation followed the project plan.

Since the local gas supplier has generously offered to support the project at no cost to the base, the project will save the base $3531.80 in energy costs during the period of performance. The base POC for this project is Stephen Butala whose coordinates are:

Email: ButalaSG@mcbh.usmc.mi
Telephone: 808-257-2171, ext 258

Table of Contents

Proposal – Proton Exchange Membrane (PEM) Fuel Cell Demonstration of Domestically Produced Residential PEM Fuel Cells in Military Facilities

1.0 Descriptive Title

LOGANEnergy Corporation Small Scale PEM Demonstration Project at the Residence of Major James Bain, USMC, PEM Demonstration Program Kaneohe Bay, HI. The installed SU1 fuel cell system provides up to 5kW of power while operating on propane fuel.

2.0 Name, Address and Related Company Information

LOGANEnergy Corporation

1080 Holcomb Bridge Road
BLDG 100- 175
Roswell, GA 30076
(770) 650- 6388

DUNS 01-562-6211
CAGE Code 09QC3
TIN 58-2292769

LOGANEnergy Corporation is a private Fuel Cell Energy Services company founded in 1994. LOGAN specializes in planning, developing, and maintaining fuel cell projects. In addition, the company works closely with manufacturers to implement their product commercialization strategies. Over the past decade, LOGAN has analyzed hundreds of fuel cell applications. The company has acquired technical skills and expertise by designing, installing and operating over 30 commercial and small-scale fuel cell projects totaling over 7 megawatts of power. These services have been provided to the Department of Defense, fuel cell manufacturers, utilities, and other commercial customers. Presently, LOGAN supports 30 Phosphoric Acid Fuel Cells (PAFC) and PEM fuel cell projects at 28 locations in 14 states, and has agreements to install 15 new projects in the US and the UK over the next 18 months.

3.0 Production Capability of the Manufacturer

Plug Power manufactures a line of PEM fuel cell products at its production facility in Latham, NY. The facility produces three lines of PEM products including the 5kW GenSys5C natural gas unit, the GenSys5P Liquid Propane (LP) Gas unit, and the GenCore 5kW standby power system. The current facility has the capability of manufacturing 10,000 units annually. Plug Power will support this project by providing remote monitoring, telephonic field support, overnight parts supply, and customer support. These services are intended to enhance the reliability and performance of the unit and achieve the highest possible customer satisfaction. Vinny Cassala is the Plug Power point of contact for this project. His phone number is 518.782.7700 ex. 1228 and his email address is vincent_cassala@plugpower.com.

4.0 Principal Investigator(s)

Name	Samuel Logan, Jr.	Keith Spitznagel
Title	President	Senior Vice President, Marketing
Company	Logan Energy Corp.	Logan Energy Corp.
Phone	770.650.6388 x 101	724-449-4668
Fax	770.650.7317	770.650.7317
Email	samlogan@loganenergy.com	kspitznagel@loganenergy.com

Name	Chris Davis
Title	Chief Operating Officer
Company	Logan Energy Corp.
Phone	770.855.3917
Fax	770.650.7317
Email	cdavis@loganenergy.com

5.0 Authorized Negotiator(s)

Name	Samuel Logan, Jr.	Keith Spitznagel
Title	President	Senior Vice President, Marketing
Company	Logan Energy Corp.	Logan Energy Corp.
Phone	770.650.6388 x 101	724-449-4668
Fax	770.650.7317	770.650.7317
Email	samlogan@loganenergy.com	kspitznagel@loganenergy.com

Name	Chris Davis
Title	Chief Operating Officer
Company	Logan Energy Corp.
Phone	770.855.3917
Fax	770.650.7317
Email	cdavis@loganenergy.com

6.0 Past Relevant Performance Information

a) Contract: PC25 Fuel Cell Service and Maintenance Contract #X1237022

Merck & Company
Ms. Stephanie Chapman
Merck & Company
Bldg 53 Northside
Linden Ave. Gate
Linden, NJ 07036
(732) 594-1686

Contract: Four-year PC25 PM Services Maintenance Agreement.

In November 2002 Merck & Company issued a four-year contract to LOGAN to provide fuel cell service, maintenance and operational support for one PC25C fuel cell installed at their Rahway, NJ plant. During the contract period the power plant has operated at 94% availability. LOGAN performs the quarterly and annual service prescribed by the UTC, and performs other maintenance as required. The periods of unavailability are chiefly due to persistent inverter problems that seem to be endemic to the Toshiba power conditioning balance of the system. Field modifications and operating adjustments have largely cured the problem. Quarterly service events take 10 hours to complete with the unit under load, and the annual event takes approximately 35 hours with the unit shut down.

b) Contract: Plug Power Service and Maintenance Agreement to support 12 5kWe GenSys 5C PEM power plants at various CA and Hawaii locations.

Plug Power
Mr. Vinny Cassala.
968 Albany Shaker Rd.
Latham, NY 12110
(518) 782-7700 ex. 1228

c) Contract: A Partners LLC; Commercial PC25 Fuel Cell Project Design, Installation and 5-year service and maintenance agreement.

Mr. Ron Allison
A Partners LLC
1171 Fulton Mall
Fresno, CA 93721
(559) 233-3262

On April 20, 2004 LOGAN completed the installation of a 600kWe PC25C Combined Heat and Power (CHP) fuel cell installation in Fresno, CA. The system operating configurations allow for both grid parallel and grid independent energy service. The grid independent system is integrated with a Multi Unit Load Sharing (MULS) electronics package and static switch, which initial development was funded by ERDC CERL in 1999. This is the third fuel cell installation that uses the MULS System. The thermal recovery package installed in the project includes a 100-ton chiller that captures 210 degree F thermal energy supplied by the three fuel cells to support cooling loads on the first three floors of the host facility. The fuel cells also provide low-grade waste heat at 140 degrees F that furnishes thermal energy to 98 water source heat pumps located throughout the 12-story building during the winter months.

7.0 Host Facility Information

Marine Corps Base Hawaii
Supporting Readiness and Global Projection

Marine Corps Base Hawaii (MCBH) Kaneohe Bay is located on the windward side of Oahu, approximately 12 miles northeast of Honolulu. The base occupies the Mokapu Peninsula, which connects to the mainland near the cities of Kaneohe and Kailua. MCBH Kaneohe Bay is home to III Marine Expeditionary Forces, Hawaii, 1st Radio Battalion, and the Marine Corps Air Facility, Kaneohe Bay. The base's position in the Pacific makes it an ideal location for strategic deployment to the Far East. The base is also a leader in environmental protection, enhancement and conservation. The base has received numerous awards for its efforts, including the 1984 Secretary of Defense Environmental Quality Award and the 1992 Secretary of the Navy Natural Resources Conservation Award.

The main access to the base is by either highway 3 (H-3) or by Mokapu Road. Other training areas include Bellows Air Force Station eight miles to the south, the Kahuku Training Area approximately 33 miles to the north and Makua Military Reservation (MMR), which is 47 miles to the west. MCBH Kaneohe Bay has a 7,500-foot runway and supporting taxiways, which, in addition to normal air operations, are used for access to the outer island training areas. The base also has a fuel pier and waterfront area, used for loading tank landing ships (LST's) and small boats for transporting equipment off-island.

The base consists of 2,951 acres of fee simple and ceded land. Only a portion of the area (140 acres) is used as a small arms range and impact area, which is included in the DOD major training assets total. The majority of the base is located on land designated as Urban. Two sections of the base are classified conservation land, which includes the Ulupau Crater area and the Nuupia Pond area. The land south of the base is used mainly for single-family residences.

The electric service provider for MCBH Kaneohe Bay is Hawaii Electric and the LPGas provider is Aloha Gas.

The map pictured below shows the location of MCBH Kaneohe Bay relative to other geographic areas and points of interest.

8.0 Fuel Cell Installation

After reviewing several possible sites on the base, the home of Major James Bain, Figures 1-4, was selected to host the installation. Maj. Bain is the commander of the base civil engineering division and was eager to act as host for the installation. Following discussion with Maj. Bain's staff it was determined that no permits would be needed prior to installing the unit. After the completion of all installation tasks the unit was commissioned on December 14, 2004 and the first start occurred one day later on December 15. After waiting for 7 weeks to gain commercial Internet Service Provider (ISP) access, web connectivity occurred on February 2, 2004 whereupon the site became fully operational.

Figure 1, Fuel Cell Site - Before

Figure 2, Fuel Cell on Pad Site with LPG tank

Figure 3, Rigging Unit onto pad

Figure 4, Wiring Metering Package

Installation Line Diagram

Kaneohe Bay MCB PEM Installation Line Diagram

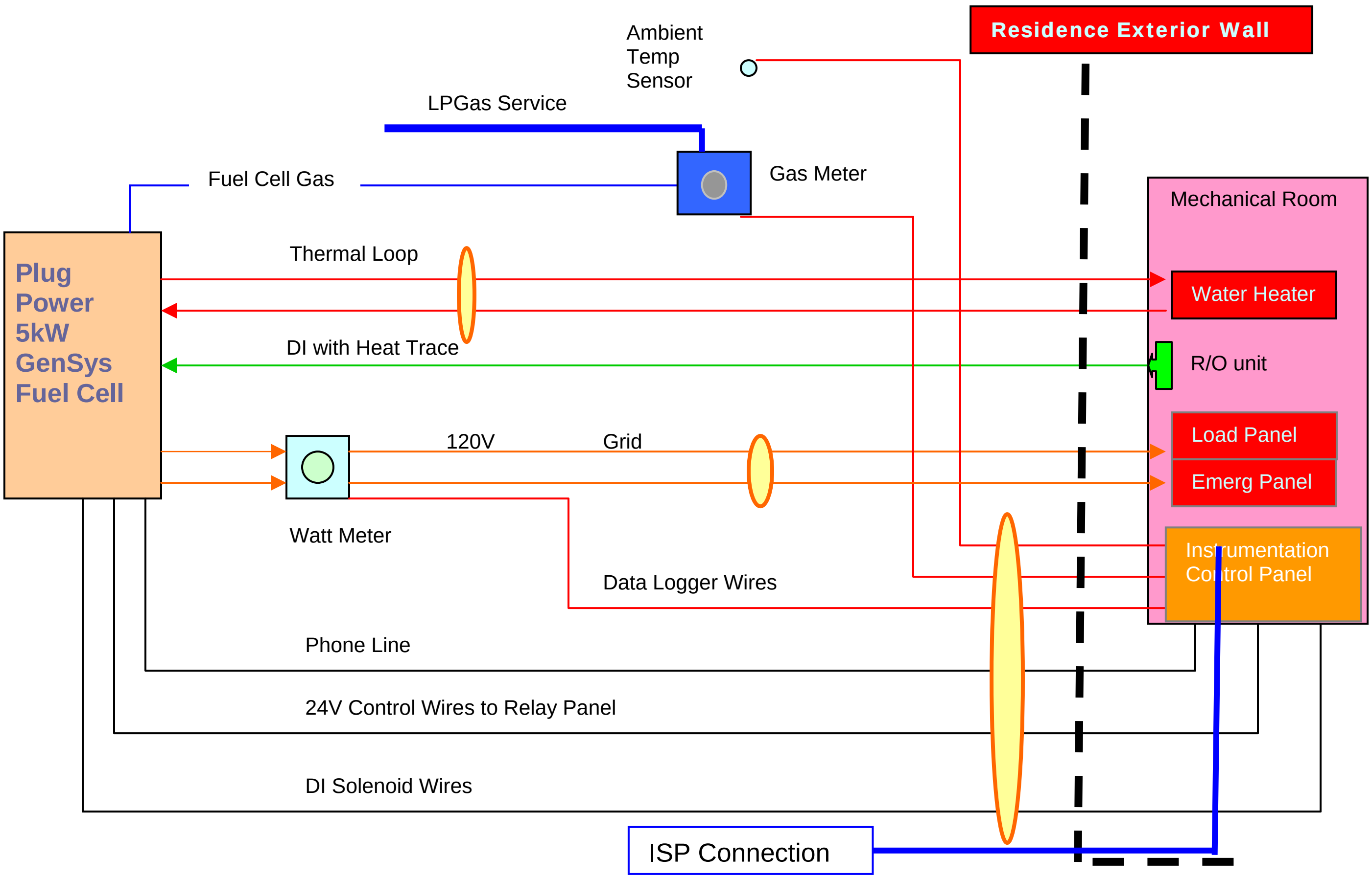


Figure 5, Line Diagram

Figure 5, above, describes a one line diagram of the MCB Kaneohe Bay fuel cell installation at the home of Marine Major James Bain. The diagram illustrates utility and control interfaces including, LPGas, power, water and instrumentation devices installed in the residential equipment room.

The electrical conduit that runs between the facility load panels and the fuel cell are approximately 40 feet. The Reverse Osmosis/Deionized (DI) water tubing that provides filtered process water to the power plant is approximately 40 feet distance, and the thermal recovery piping that runs between the fuel cell and the hot water heater is also approximately 40 feet.

9.0 Electrical System

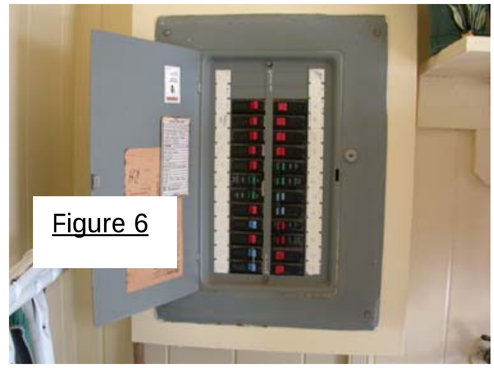


Figure 6

The fuel cell inverter has a power output of 110/120 VAC at 60 Hz, matching the building distribution panel in the mechanical room with its connected loads at 110/120 VAC. The installation includes both a grid parallel and a grid independent configuration as illustrated in Figure 5 above. The unit is connected to the base grid through a 50 amp circuit breaker in the residence's existing service panel pictured above, Figure 6. The unit's emergency conductor provides power to a new 50amp critical circuit panel that serves several kitchen appliances and other plug loads. A two-pole wattmeter, seen attached to the face of the fuel cell in Figure 4 above, monitors both the grid parallel and grid independent conductors to record fuel cell power distribution to both the existing panel and the new critical load panel. The fuel cell electrical disconnect can be seen to the right of the wattmeter also in Figure 4 above. The disconnect switch allows the technician to electrically isolate the fuel cell from the residential power supply to make repairs t o the unit without causing an inconvenience to the occupants.

10.0 Thermal Recovery System

Fuel Cell waste heat flows to a Heliodyne heat transfer coil that maintains the domestic hot water tank at 130 degrees F, which is adequate to meet domestic hot water quality and demand for a family of four. The Heliodyne is a product originally developed for the solar collector industry, which has proven itself very useful for fuel cell thermal applications as well. The heat exchanger is a coil within a coil that permits a closed hot water loop to transfer heat from the fuel cell in a counter flow manner with water circulation from the tank.

Figure 7, below, illustrates how the Heliodyne transfers fuel cell waste heat to the existing hot water tank. The black “U” shaped coil is a Heliodyne Heat Exchanger seen attached to the tank. The other major thermal recovery components are indicated in the boxes below with arrows pointing to their locations.

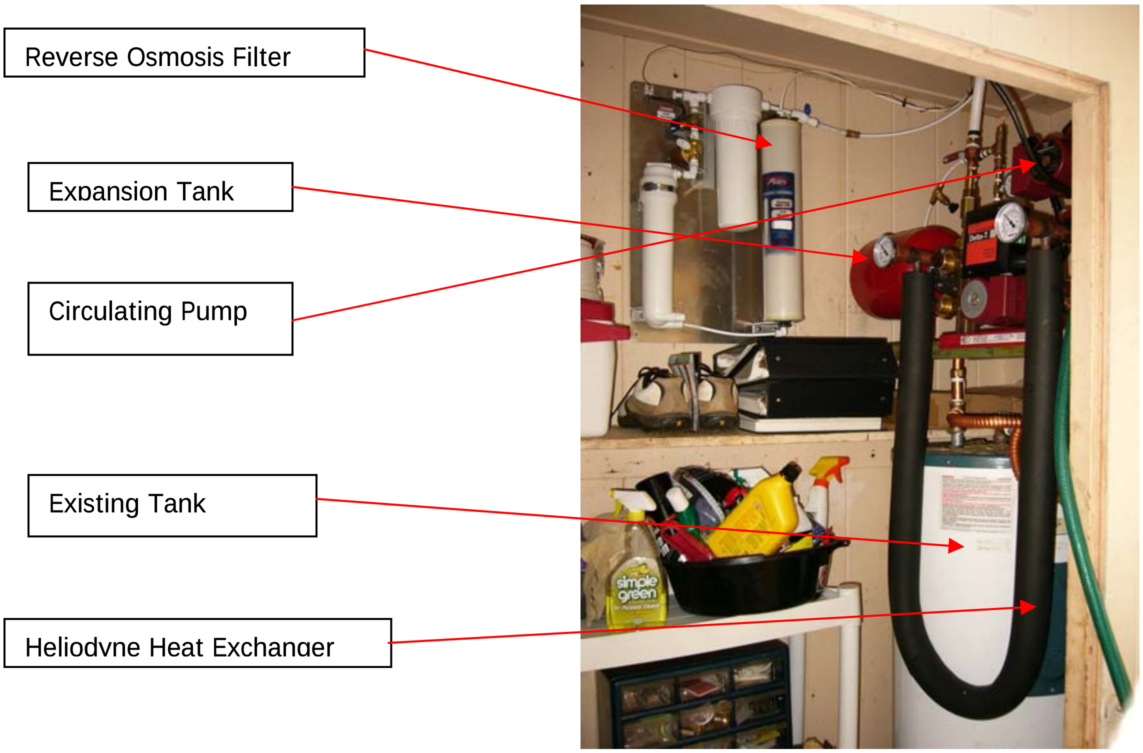


Figure 7, Thermal Recovery Package

11.0 Data Acquisition System

Figure 8 displays a photo of the Connected Energy Remote Terminal Unit, which transmits fuel cell operating and performance data via a Virtual Private Network (VPN) to LOGAN’s distributed generation control center in Rochester, NY.

Over the course of developing many sites in its DOD PEM Programs, LOGAN has encountered great difficulty in acquiring a dedicated phone line for the fuel cell in every case. In the best case this has delayed starting the Demonstration Period by three weeks. Most sites have proven far more difficult. These experiences have taught LOGAN to be very explicit with the host POC at the kick-off meetings concerning the necessity for providing a dedicated phone line, since much of the success of the project is dependent upon reliable communications with the unit.

Figure 8, RTU Housing

As was the custom at its FY'02 PEM installation sites, LOGAN decided once again to install a web-based, real time, data management and reporting system at MCBH Kaneohe Bay. To do this LOGAN contracted with Connected Energy Corporation (CEC) to provide the service. The drawing seen in Figure 9, below, describes the architecture of the CEC system operating at the site. The system provides a comprehensive data acquisition solution, and also incorporates remote control, alarming, remote notification, and reporting functions as well by means of a VPN that maintains connectivity between the fuel cell site and the control center in Rochester, NY.

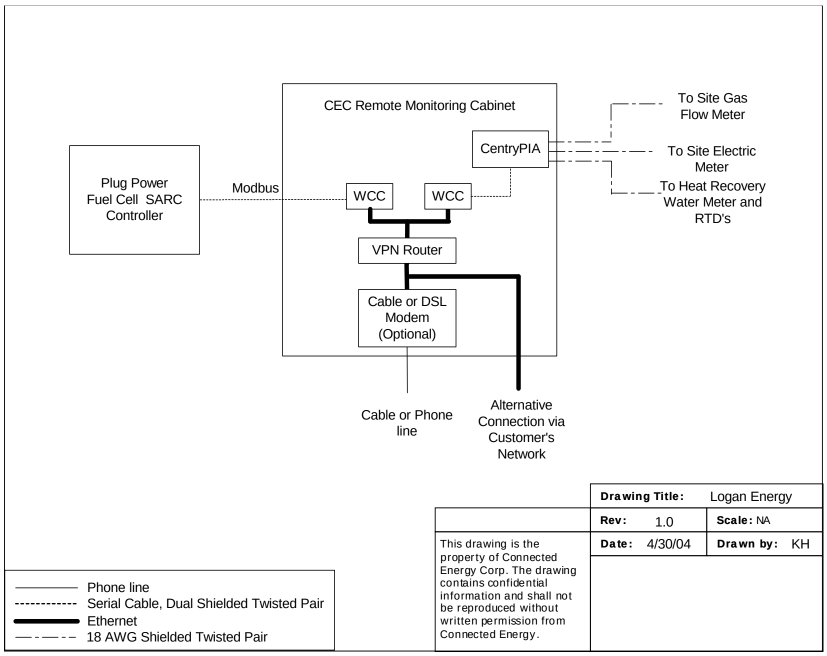


Figure 9, Connected Energy System Architecture

With the introduction of this system at Kaneohe Bay, LOGAN continues to learn new lessons in Web based CHP resource management. The web communications installation at Maj. Bain's residence is provided by a local ISP, Oceanic Cable.

An important lesson that LOGAN has learned with this system is the critical role that individual instrumentation component parts play in supplying the data to the web interface. The CE system requires very precise signals from the outputs of these devices. The gas meters, wattmeters, flow meters and thermal elements invariably require signal strength adjustment at the Remote Terminal Unit (RTU) terminals to insure that their discrete inputs are readable by the CEC system. Discovering the proper voltage range required for each signal loop is most often achieved by trial and error, requiring multiple site visits to establish a readable connection. In other instances LOGAN has discovered that flow metering devises and thermal couples often require high levels of maintenance and/or replacement to support continuous data collection.

This site has produced its own particular set of service issues with the CE system, which show up as an inability of the RTU to retrieve a constant stream of data. Instead, LOGAN has been able to retrieve only intermittent data after three months of operation. Unfortunately, after exhaustive troubleshooting the system and changing many components, the solution has not yet become apparent. IN order to correct t his deficiency, LOGAN has launched a comprehensive installation process/materials/

practices review in an all out effort to correct the problem. We believe that is will be solved in short order.

Figure 10 is an example of one of many data screens that are maintained by the CEC system and displayed on the web. Due to the problem described above the screen provides only incomplete data in the data display boxes. A sample data graph, providing kWh data, is also attached to Appendix 2.

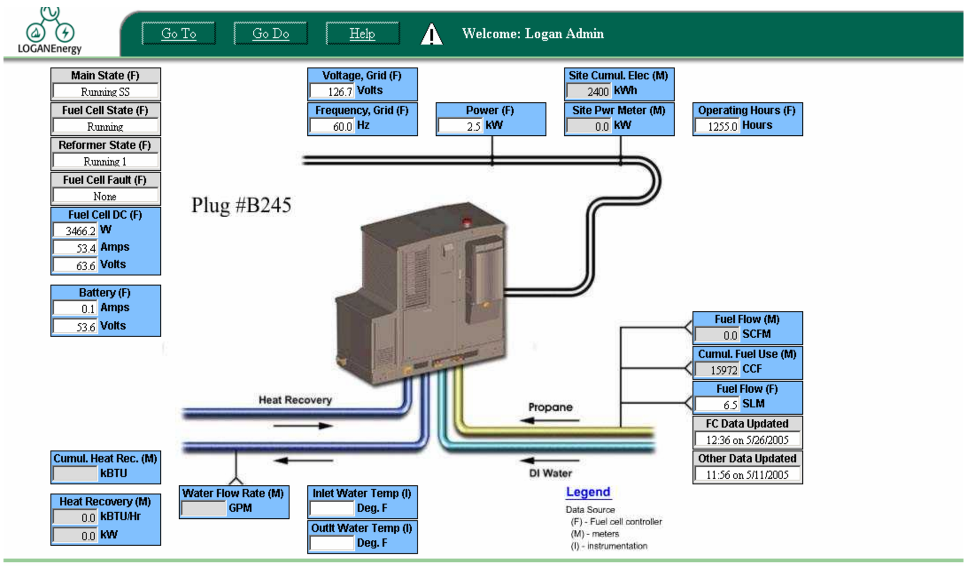


Figure 10, Connected Energy Web Data Screen

Note that due to an ongoing problem with the system's ability at this site to capture a continuous data stream, some data points were not available at the time this screen was inserted in to the body of the report.

12.0 Fuel Supply System

The Plug Power unit provided for this demonstration is an LPGas fueled system. Aloha Gas, the fuel supplier installed the 250 gallon fuel storage tank seen in the photo below labeled Figure 11. While operating at a dispatch set point of 2.5kWh, the unit consumes .53 gallons per hour. This equates to 20% electrical efficiency, which is low by conventional power generation standards. However, this is a first generation LPGas fuel cell product, and the more important issue will be to determine that the product functions in accordance with its design specifications and achieves 90% availability during the test period. When thermal recovery is added to the efficiency equation, then overall efficiency could exceed 55% under ideal circumstances.

A regulator at the fuel cell gas inlet maintains the correct fuel cell operating pressure at 14 inches water column. The size of the tank and its location in the backyard would appear to be very obtrusive for a family with young children. However, as the demonstration project is for one year Major Bain agreed to the short-term inconvenience. As propane fueled systems move into the larger economy, this issue will need to be addressed with greater thought and care to make the tank less conspicuous to the urban homeowner. This issue will have far less impact for rural installations. It should be noted that Aloha Gas is providing fuel service at no cost to the base for the duration of the project as a means of gaining knowledge to support future fuel cell opportunities.

Figure 11, photo of 250 gallon LPGas supply tank located in Maj. Bain’s back yard.

13.0 Installation Costs

1) Water (per 1,000 gallons)		$ 0.85				
2) Utility (per KWH)		$ 0.130				
3) LPGas (per gallon)		$ -				
First Cost			**Estimated**		**Actual**	**Variance**
Plug Power 5 kW SU-1			$ 75,000		$ 75,000.00	$ -
Shipping			$ 4,800		$ 1,200.00	$ (3,600.00)
Installation electrical			$ 4,875		$ 5,351.00	$ 476.00
Installation mechanical, LPGas & thermal			$ 14,000		$ 8,946.00	$ (5,054.00)
Web Package			$ 2,000		$ 8,770.00	$ 6,770.00
Site Prep, labor materials			$ 375		$ 375.00	$ -
Training			$ 4,500		$ 4,500.00	$ -
Lodging and Perdiem					$ 2,461.00	$ 2,461.00
Technical Supervision/Start-up			$ 3,000		$ 3,000.00	$ -
Total			**$ 108,550**		**$ 109,603**	**$ 1,053.00**
Assume Five Year Simple Payback			$ 21,710		$ 21,920.60	$ 210.60
Forcast Operating Expenses	Vol/hr	$/Hr	$/ Yr			
LPGas gallons	0.5300	$ -	$ -			
Water Gallons per Year	14,016		$ 11.91			
Total Annual Operating Cost					$ 11.91	
Economic Summary						
Forcast Annual kWH		19710				
Annual Cost of Operating Power Plant		$ 0.001	kWH			
Credit Annual Thermal Recovery Rate		($0.030)	kWH			
Project Net Operating Cost		($0.029)	kWH			
Displaced Utility cost		$ 0.130	kWH			
Energy Savings (Cost)		$ 0.159	kWH			
Annual Energy Savings (Cost)		$ 3,135.80				

Explanation of Calculations:

Actual First Cost Total is a *sum* of all the listed first cost components.

Assumed Five Year Simple Payback is the Estimated First Cost Total *divided by* 5 years.

Forecast Operating Expenses:

LPGas usage in a fuel cell system set at 2.5 kW will consume 0.53 gallons LPGas per hour. The cost per hour is $0.0 gallons (fuel provided to the project free of charge) per hour *x* the cost of LPGas to the site. The cost at this site is $0.0 for fuel.

GenSys fuel cell systems set at 2.5 kW will consume 1.6 gallons of water per hour through the DI panel. The total volume of water consumed at 14,016 gallons per year is 1.6 gph *x* 8760 hours per year. The cost per year at $170.01 is 14,016 gph *x* cost of water to the site at $0.85 per 1000 gallons.

The Total Annual Operating Cost, $11.91 is the *sum of* the cost per year for fuel and the cost per year for the water consumption.

Economic Summary:

The Forecast Annual kWh at 19,710 kWh is the product of 2.5 kW set-point for the fuel cell system *x* 8760 hours per year *x* 0.9. The 0.9 is for 90% availability.

The Annual Cost of Operating the Power Plant at $0.001 per kWH is the Total Annual Operating Cost of $11.91 *divided by* the forecast annual kWh of 19,710 kWh.

The Credit Annual Thermal Recovery at -$0.029/kWh is 7800 *divided by* 3414. This is then *multiplied by* 0.9 *x* 0.1 *x* the cost of electricity at $0.1300 per kWh *x* (-1). As a credit to the cost summary, the value is expressed as a negative number.

The Project Net Operating Cost is the *sum* of the Annual Cost of Operating the Power Plant *plus* the Credit Annual Thermal Recovery. In this case it is a negative number and a credit to the project since there is no cost for fuel. The project generates a net savings to the base, which in kWh is the sum of the displaced cost of grid power plus the savings expressed in kWh through thermal recovery.

The Displaced Utility Cost is the cost of electricity to Kaneohe Bay per kWh.

Energy Savings (cost) equals the Displaced Utility Cost *minus* the Project Net Operating Cost.

Annual Energy Savings (cost) equals the Energy Savings *x* the Forecast Annual kWh.

14.0 Milestones/Improvements

No new milestones or improvements were achieved during this demonstration.

15.0 Decommissioning/Removal/Site Restoration

The Kaneohe PEM fuel cell was shutdown for the final time on May 13, 2006. The fuel cell was removed from the site and put into storage at the Kaneohe Public Works building awaiting shipping to the Hawaii Natural Energy Institute. All piping and conduit was removed and the site was returned to its pre-demonstration condition.

Upon completion of the PEM demonstration the fuel cell was donated to the Hawaii Natural Energy Institute (HNEI) http://www.hnei.hawaii.edu/fuelcell.asp. HNEI is a research unit of the University of Hawaii that seeks new forms of energy that would supplant the nation's tremendous dependence on fossil fuels. HNEI has a major fuel cell research and development program that conducts testing of fuel cells for commercial and military applications.

The fuel cell was shipped to the HNEI on the big island of Hawaii on June 19, 2006.
The POC at HNEI is:

Richard E. Rocheleau
HNEI Director/Research Chemical Engineer
Ph: (808) 956-8346
Fax: (808) 956-2336
Email: rochelea@hawaii.edu

16.0 Additional Research/Analysis

No additional research or analyses were performed at this site.

17.0 Conclusions/Summary

On March 28, 2006 LOGANEnergy was notified, at the request of Kaneohe Bay MCB, to stop work at the Kaneohe Bay PEM demonstration site. The project did not resume. A copy of the official notification is attached.

At the time the project ended the Kaneohe Bay GenSys5C fuel cell system number SU01B000000245 had completed 13 months of operation. During this period the Kaneohe Bay PEM power plant ran at 67% availability. The fuel cell was unavailable for a total of 3,138 hours.

This project had its share of difficulties keeping the fuel cell running. There was a combination of issues that LOGAN believes lead to the low operating availability of this demonstration. The first was the fuel cell system just did not operate up to the standard that the general Plug Power SU1 fleet did and as a result required constant troubleshooting of issues and ultimately repair of components. The shipment of replacement parts to Hawaii on a regular basis just added to the availability woes due to the time it took to receive them. The second area that contributed to the low demonstration availability was LOGAN's use of a local service provider. For standard preventative maintenance and simple unscheduled outages this strategy would have worked fine but with this unit a higher level of technical experience was required and as such the local service provider would have to spend significant time on the phone to resolve the issue or a LOGAN technician would have to travel to Hawaii to ultimately resolve it. As a result the test period concluded with a total 6,366 fuel cell load hours.

Despite the problems, the lessons learned at this site will have positive implications for future PEM operations and customer services. As these experiences are transferred to future installations they will directly benefit the community of CERL projects and equally enhance the reliability of future Plug Power products. Finally, this project elevated the awareness of fuel cell technology for the Marine Corps and for the growing fuel cell community in Hawaii.

DEPARTMENT OF THE ARMY
VICKSBURG DISTRICT CORPS OF ENGINEERS
4155 CLAY STREET
VICKSBURG, MISSISSIPPI 39180-3435

RECEIVED
APR - 3 2006

REPLY TO
ATTENTION OF:

http://www.mvk.usace.army.mil/

March 28, 2006

LoganEnergy Corporation
Attn: Mr. Samuel Logan
1080 Holcomb Bridge Road
Bldg 100, Suite 175
Roswell, GA 30076-6206

Dear Mr. Logan:

Reference is made to ERDC-CERL Contract Number W9132T-04-C-0023 entitled: "Proton Exchange Membrane Fuel Cells Demonstration of Domestically Produced PEM Fuel Cells in Ten Military Facilities."

At the request of the MCB Kaneohe Bay, HI installation personnel, you are in accordance with Section F, Deliveries or Performance, FAR Clause 52.242-15, Stop-Work Order, ordered to stop work on the PEM Fuel Cell demonstration at MCB Kaneohe Bay, HI. It is anticipated that the work will not be resumed and work at this location will be terminated.

If you have any questions, or require additional information, please contact Joyce Roberts, Contract Specialist at email: Joyce.J.Roberts@erdc.usace.army.mil; phone: 217/373-4479.

Sincerely,

Deloras J. Adamson
Contracting Officer

Appendix

1. Monthly Performance Data

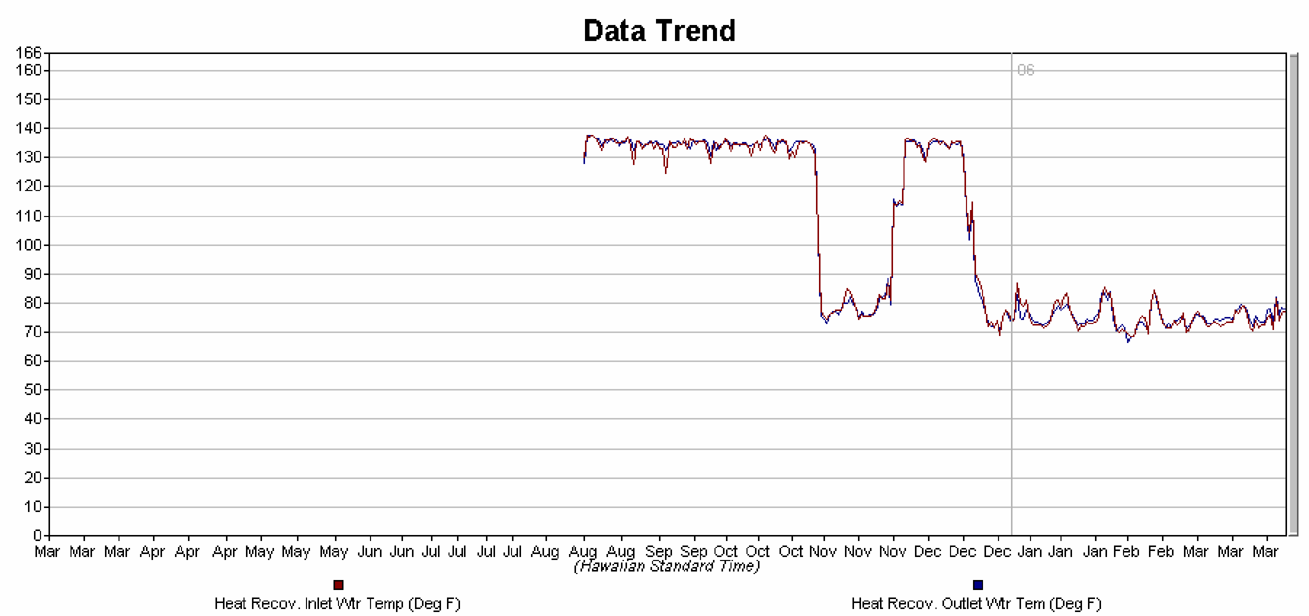
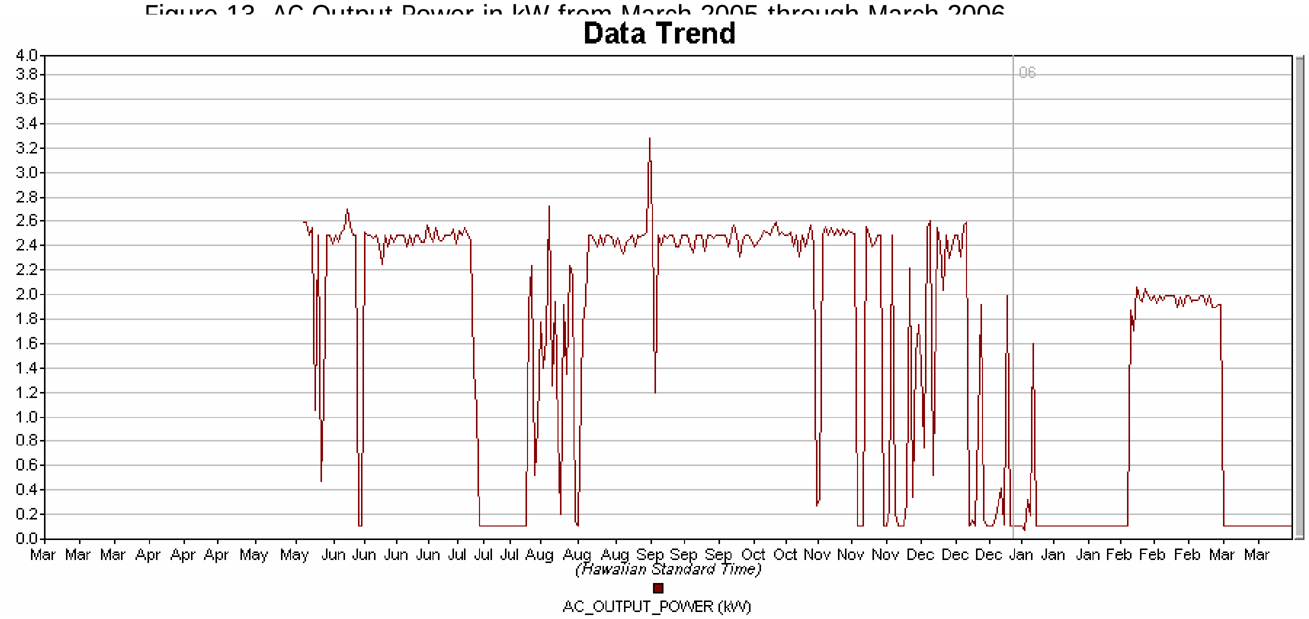


Figure 12, Heat Recovery Temperature Delta from March 2005 through March 2006

Figure 13, AC Output Power in kW from March 2005 through March 2006



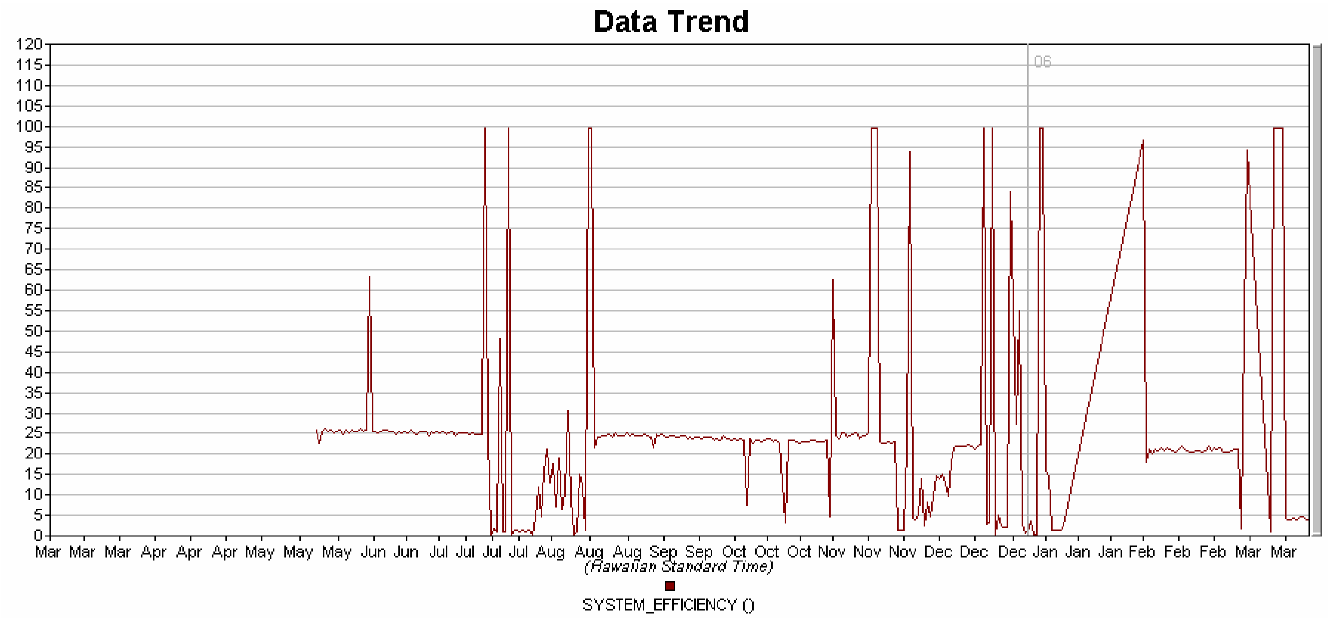


Figure 14, Overall System Efficiency (%) from March 2005 through March 2006

Kaneohe Bay

Hawaii

	Mar-05	Apr-05	May-05	Jun-05	Jul-05	Aug-05	Sep-05	Oct-05	Nov-05	Dec-05	Jan-06	Feb-06	Mar-06
Run Time (Hours)	193	530	729	711	323	573	720	744	504	447	180	515	192
Time in Period (Hours)	744	720	744	720	744	744	720	744	720	744	744	672	744
Availability (%)	26%	74%	98%	99%	43%	77%	100%	100%	70%	60%	24%	77%	26%
Energy Produced (kWe-hrs AC)	493.0	1289.0	1553.0	1742.0	797.0	802.6	1817.4	1834.0	767.0	942.9	283.0	1015.4	376.3
Output Setting (kW)	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Average Output (kW)	2.55	2.43	2.13	2.45	2.47	1.40	2.52	2.47	1.52	2.11	1.57	1.97	1.96
Capacity Factor (%)	13.25%	35.81%	41.75%	48.39%	21.42%	21.58%	50.48%	49.30%	21.31%	25.35%	7.61%	30.22%	10.12%
Fuel Usage, LHV (kWe-hrs AC)	2211	5664	6847	8200	3325	3691	6323	7753	3459	5234	1803	5116	1876
Fuel Usage, LHV (BTUs)	7.54E+06	1.93E+07	2.34E+07	2.80E+07	1.13E+07	1.26E+07	2.16E+07	2.65E+07	1.18E+07	1.79E+07	6.15E+06	1.75E+07	6.40E+06
Fuel Usage (SCF)	7458	19105	23096	27659	11216	12450	21328	26152	11668	17655	6082	17257	6328
Electrical Efficiency (%)	22.31%	22.77%	22.69%	21.26%	23.98%	21.76%	28.76%	23.67%	22.19%	18.03%	15.71%	19.86%	20.07%
Thermal Heat Recovery (BTUs)	0	0	0	0	0	0	0	0	0	0	0	0	0
Heat Recovery Rate (BTUs/hour)	0	0	0	0	0	0	0	0	0	0	0	0	0
Thermal Efficiency (%)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Overall Efficiency (%)	22.31%	22.77%	22.69%	21.26%	23.98%	21.76%	28.76%	23.67%	22.19%	18.03%	15.71%	19.86%	20.07%
Number of Scheduled Outages	0	0	1	0	0	0	0	0	1	0	0	0	0
Scheduled Outage Hours	0	0	15	0	0	0	0	0	20	0	0	0	0
Number of Unscheduled 0Outages	1	1	0	1	1	1	1	0	2	1	2	1	1
Unscheduled Outage Hours	551	190	0	9	421	171	0	0	196	297	564	157	552

2) Daily Work Logs
LOGANEnergy Field Technicians
September '04 – July '05

LOGANEnergy Corp.					
Monthly Site Report					
Period	September-04				
Site	Kaneohe Bay				
Engineer	**Date**	**PP S/N**	**Activity**	**Mileage**	**Hours**
Collard	9/7/2004	245	Drive to Los Angeles		
Collard	9/8/2004	245	Fly to Hawaii		
Collard	9/9/2004	245	Visit and evaluate the Kaneohe Bay and Schofield Barracks site		
Collard	9/10/2004	245	Meet with Hawaii Electric and revisit Pearl and Kaneohe Bay.		
Collard	9/11/2004	245	Fly home Drive LA to Twenty-nine Palms		

LOGANEnergy Corp.					
Monthly Site Report					
Period	November-04				
Site	Kaneohe Bay				
Engineer	**Date**	**PP S/N**	**Activity**	**Mileage**	**Hours**
Altemoose	11/12/2004	245			
			Batteries Installed		0.5
			Wiring Connections Inspected for Loose Connections and Tightness		0.5
			Plumbing and Mechanical Connections Inspected for Tightness		0.5
			Stack Installed		1.00
			Stack Coolant Installed		0.5
			Air Purged from Stack Coolant		0.2
Altemoose	11/15/2004	245			
			Inverter Power Cable Installed		0.5
			Inverter Power Polarity Corrected		0.5
			RS 232 /Modem Cable Installed		1.00
			DI Panel Drain Installed		1.30
			System Drain Tubing Installed		0.2
			Modem Test Passed		0.5
			Coolant Leak Checked		0.5
			Water Leak Checked		0.5
			Flammable Gas Leak Checked		0.5
Harvell	11/18/2004	245	Kaneohe needs about a half day of prep and it will be ready to run. Michael will try and knock that out if he has time. The bad news is that the cable people cannot come until Dec. 8th. That puts K Bay third on our list of priorities.		
Harvell	11/23/2004	245	Completed most of the installation on the 3 Hawaii units. Worked to place units on their pads, gather all the parts needed for all 3 units; gave oversight to contractors at Kaneohe and Schofield; ran control wires, DI lines, CAT5 and phone lines, installed iSTEC, mini-meter, DI panels, Connected Energy cabinets, stacks, and pulse wires. Arranged for communications, made multiple trips to buy supplies, made multiple trips to all 3 bases		

			locating and picking up supplies as they were shipped in, coordinated propane tank placements and filling.		

LOGANEnergy Corp.					
Monthly Site Report					
Period	December-04				
Site	Kaneohe Bay				
Engineer	**Date**	**PP S/N**	**Activity**	**Mileage**	**Hours**
Collard	12/13/2004	245	Installed new software. This process is totally unacceptable from Logans' point of view. This kind of delay is expensive especially in situations where perdiem and hotels are involved. The heavy schedule for installs and maintenance prohibits our having to mess with this kind of problem. Software updates should take no longer than 30 minutes start to finish. I could not attempt a start today because of all the time wasted getting the software in.		3
Collard	12/14/2004	245	Started this fuel cell with no issues. FC came on line with good voltage and 2.600 Kw output. Looks like the software is ok at this point. Checked heat recovery. It is working well. High-speed internet connection is working well. Plugged it into the connected energy box. I need to send email to Kevin Haan at CE to have him activate this site. This machine looks good and we should be able to start the acceptance day in the morning. I called the modem with my phone and the modem answered. I'll call the FC from my room tonight.		5.5
Collard	12/15/2004	245	FC modem was not answering this morning. I went to check if machine was running and work on modem issue. Steve and I arrived and found the FC running well. I tested the modem by calling it and the modem answered. It was late but we tried take it up to five Kw. It got to 4487 Watts. If we could have left it there for another hour it would have gotten there. This FC has run 30 hrs continuous.		2

LOGANEnergy Corp.					
Monthly Site Report					
Period	Feburary-05				
Site	Kaneohe Bay				
Engineer	**Date**	**PP S/N**	**Activity**	**Mileage**	**Hours**
	2/26/2005	245			
			1109426183,2/26/2005 8:56:23 AM,Running (51)SHUTDOWN, LEVS5_HUMID_LOW_SD, Error Code: (377)(0)		
			1109426183,2/26/2005 8:56:23 AM,SD Ref Cool (104)EVENT, SHUTDOWN_EVENT, Error Code: (1001)(0)		
			1109426300,2/26/2005 8:58:20 AM,Shutdown Complete (105)ALERT, AUTO_RESTART, Error Code: (603)(0)		
			1109426302,2/26/2005 8:58:22 AM,Reformer Purge (31)EVENT, STARTUP_EVENT, Error Code: (1000)(0)		

			1109438839,2/26/2005 12:27:19 PM,Running (51)SHUTDOWN, LEVS5_HUMID_LOW_SD, Error Code: (377)(0)		
			1109438839,2/26/2005 12:27:19 PM,SD Ref Cool (104)EVENT, SHUTDOWN_EVENT, Error Code: (1001)(0)		
			1109438956,2/26/2005 12:29:16 PM,Shutdown Complete (105)ALERT, AUTO_RESTART, Error Code: (603)(0)		
			1109438959,2/26/2005 12:29:19 PM,Reformer Purge (31)EVENT, STARTUP_EVENT, Error Code: (1000)(0)		
	2/28/2005	245			
			1109592950,2/28/2005 7:15:50 AM,Reformer Purge (31)EVENT, STARTUP_EVENT, Error Code: (1000)(0)		
			1109598904,2/28/2005 8:55:04 AM,Running Warmup (50)SHUTDOWN, LEVS5_HUMID_LOW_SD, Error Code: (377)(0)		
			1109598904,2/28/2005 8:55:04 AM,SD Ref Cool (104)EVENT, SHUTDOWN_EVENT, Error Code: (1001)(0)		
			1109628251,2/28/2005 5:04:11 PM,ESTOP (107)ESTOP, HW_ESTOP_SARC_L0, Error Code: (534)(0)		
			1109628261,2/28/2005 5:04:21 PM,ESTOP (107)ESTOP, HW_ESTOP_SARC_L0, Error Code: (534)(0)		
			1109628282,2/28/2005 5:04:42 PM,ESTOP (107)ESTOP, HW_ESTOP_SARC_L0, Error Code: (534)(0)		
			1109628302,2/28/2005 5:05:02 PM,ESTOP (107)ESTOP, HW_ESTOP_SARC_L0, Error Code: (534)(0)		
			1109629589,2/28/2005 5:26:29 PM,Reformer Purge (31)EVENT, STARTUP_EVENT, Error Code: (1000)(0)		

LOGANEnergy Corp.					
Monthly Site Report					
Period	March-05				
Site	Kaneohe Bay				
Engineer	**Date**	**PP S/N**	**Activity**	**Mileage**	**Hours**
Butala	3/14/2005	245	Checked DI water flow and inlet pressure. Pressure at 50psi, but low flow at machine. Checked DI filters. Looked good. Restarted unit. Unit again shut down on LEVS5 low.		3
Butala	3/18/2005	245	Changed out WPP filters and o-ring on sol. valve. Restarted unit, shut down on LEVS5 low.		2
Butala	3/28/2005	245	Changed internal water filter and LEVS5 sensor. Restarted unit – unit did not shut down.		

LOGANEnergy Corp.					
Monthly Site Report					
Period	April-05				
Site	Kaneohe Bay				
Engineer	**Date**	**PP S/N**	**Activity**	**Mileage**	**Hours**
	4/6/2005	245			
			1112825300,4/6/2005 6:08:20 PM,Running (51)ALERT, GRID_LOSS, Error Code: (632)(0)		
			1112825300,4/6/2005 6:08:20 PM,Running (51)ALERT, SYSTEM_TRANSITIONED_TO_STANDBY, Error Code: (630)(0)		
			1112825643,4/6/2005 6:14:03 PM,Run-GL-SB (53)ALERT,		

			SYSTEM_TRANSITIONED_TO_GRID, Error Code: (631)(0)		
	4/7/2005	245			
			1112917249,4/7/2005 7:40:49 PM,Running (51)SHUTDOWN, O2_CH4_HIGH_SD, Error Code: (512)(0)		
			1112917249,4/7/2005 7:40:49 PM,SD Ref Cool (104)EVENT, SHUTDOWN_EVENT, Error Code: (1001)(0)		
			1112917366,4/7/2005 7:42:46 PM,Shutdown Complete (105)ALERT, AUTO_RESTART, Error Code: (603)(0)		
			1112917369,4/7/2005 7:42:49 PM,Reformer Purge (31)EVENT, STARTUP_EVENT, Error Code: (1000)(0)		
			1112922958,4/7/2005 9:15:58 PM,Reformer Purge (31)SHUTDOWN, TIMEOUT_PURGE, Error Code: (403)(0)		
	4/13/2005	245			
			1113436724,4/13/2005 7:58:44 PM,Reformer Purge (31)EVENT, STARTUP_EVENT, Error Code: (1000)(0)		
			1113440974,4/13/2005 9:09:34 PM,Reformer Purge (31)SHUTDOWN, TIMEOUT_PURGE, Error Code: (403)(0)		
			1113440974,4/13/2005 9:09:34 PM,Unknown (100)EVENT, SHUTDOWN_EVENT, Error Code: (1001)(0)		
	4/15/2005	245			
			1113610433,4/15/2005 8:13:53 PM,Reformer Purge (31)EVENT, STARTUP_EVENT, Error Code: (1000)(0)		
			1113614958,4/15/2005 9:29:18 PM,Reformer Warmup (32)ALERT, TIMEOUT_HUM_FILL, Error Code: (404)(0)		
	4/20/2005	245			
			1113972343,4/20/2005 12:45:43 AM,Running (51)ALERT, LOW_CELL_TRIP_ALERT, Error Code: (500)(0)		
			1113985664,4/20/2005 4:27:44 AM,Running (51)ALERT, GRID_LOSS, Error Code: (632)(0)		
			1113985664,4/20/2005 4:27:44 AM,Running (51)ALERT, SYSTEM_TRANSITIONED_TO_STANDBY, Error Code: (630)(0)		
			1113985675,4/20/2005 4:27:55 AM,Run-GL-SB (53)ALERT, SYSTEM_TRANSITIONED_TO_GRID, Error Code: (631)(0)		
	4/23/2005	245			
			1114269218,4/23/2005 11:13:38 AM,Running (51)ALERT, LOW_CELL_TRIP_ALERT, Error Code: (500)(0)		
Butala	4/29/2005	245	Checked wiring, RU11 wired incorrectly.		6.5

LOGANEnergy Corp.					
Monthly Site Report					
Period	May-05				
Site	Kaneohe Bay				
Engineer	**Date**	**PP S/N**	**Activity**	**Mileage**	**Hours**
	5/6/2005	245			
			1115384823,5/6/2005 9:07:03 AM,Unknown (100)ALERT, REMOTE_REQUESTED_SHUTDOWN, Error Code: (600)(0)		
			1115384823,5/6/2005 9:07:03 AM,SD Ref Cool (104)EVENT, SHUTDOWN_EVENT, Error Code: (1001)(0)		
			1115385670,5/6/2005 9:21:10 AM,SD Ref Cool (104)ESTOP, HW_ESTOP_TCO_01_PRES7_L1, Error Code: (527)(0)		
			1115385670,5/6/2005 9:21:10 AM,SD Ref Cool (104)ESTOP,		

			HW_ESTOP_FG1_L5, Error Code: (531)(0)		
			1115385670,5/6/2005 9:21:10 AM,SD Ref Cool (104)ESTOP, HW_ESTOP_FG3_L6, Error Code: (532)(0)		
			1115385690,5/6/2005 9:21:30 AM,SD Ref Cool (104)ESTOP, HW_ESTOP_TCO_01_PRES7_L1, Error Code: (527)(0)		
			1115385690,5/6/2005 9:21:30 AM,SD Ref Cool (104)ESTOP, HW_ESTOP_FG1_L5, Error Code: (531)(0)		
			1115385690,5/6/2005 9:21:30 AM,SD Ref Cool (104)ESTOP, HW_ESTOP_FG3_L6, Error Code: (532)(0)		
			1115385700,5/6/2005 9:21:40 AM,SD Ref Cool (104)ESTOP, HW_ESTOP_TCO_01_PRES7_L1, Error Code: (527)(0)		
			1115385700,5/6/2005 9:21:40 AM,SD Ref Cool (104)ESTOP, HW_ESTOP_FG1_L5, Error Code: (531)(0)		
			1115385700,5/6/2005 9:21:40 AM,SD Ref Cool (104)ESTOP, HW_ESTOP_FG3_L6, Error Code: (532)(0)		
			1115385843,5/6/2005 9:24:03 AM,Reformer Purge (31)EVENT, STARTUP_EVENT, Error Code: (1000)(0)		
			1115389467,5/6/2005 10:24:27 AM,Reformer Purge (31)ESTOP, SOL21_AIR_VALVE_FAILED_OPEN, Error Code: (624)(0)		
			1115389467,5/6/2005 10:24:27 AM,Unknown (106)EVENT, SHUTDOWN_EVENT, Error Code: (1001)(0)		
Butala	5/10/2005	245	Worked with Mark Ginther of CE on wiring. CE getting intermittent data. Plumbers re-plumbed CHP piping.		7
Butala	5/12/2005	245	Unit accepted.		6
	5/24/2005	245			
			1116938193,5/24/2005 8:36:33 AM,Running (51)SHUTDOWN, LOSS_INVERTER_COMM, Error Code: (523)(0)		
			1116938193,5/24/2005 8:36:33 AM,SD Ref Cool (104)EVENT, SHUTDOWN_EVENT, Error Code: (1001)(0)		
			1116938339,5/24/2005 8:38:59 AM,Shutdown Complete (105)ALERT, ABORT_DATA_TRANSFER, Error Code: (131)(0)		
			1116939122,5/24/2005 8:52:02 AM,Reformer Purge (31)EVENT, STARTUP_EVENT, Error Code: (1000)(0)		
			1116939487,5/24/2005 8:58:07 AM,Unknown (100)ALERT, REMOTE_REQUESTED_SHUTDOWN, Error Code: (600)(0)		
			1116939487,5/24/2005 8:58:07 AM,SD Ref Cool (104)EVENT, SHUTDOWN_EVENT, Error Code: (1001)(0)		
			1116939958,5/24/2005 9:05:58 AM,Reformer Purge (31)EVENT, STARTUP_EVENT, Error Code: (1000)(0)		
	5/27/2005	245			
			1117198735,5/27/2005 8:58:55 AM,Running (51)ALERT, LOW_CELL_TRIP_ALERT, Error Code: (500)(0)		
			1117199415,5/27/2005 9:10:15 AM,Unknown (100)ALERT, REMOTE_REQUESTED_SHUTDOWN, Error Code: (600)(0)		
			1117199415,5/27/2005 9:10:15 AM,SD Ref Cool (104)EVENT, SHUTDOWN_EVENT, Error Code: (1001)(0)		
			1117199968,5/27/2005 9:19:28 AM,Power Down (200)ALERT, REMOTE_REQUESTED_ESTOP, Error Code: (601)(0)		
			1117202928,5/27/2005 10:08:48 AM,Reformer Purge (31)EVENT, STARTUP_EVENT, Error Code: (1000)(0)		
			1117203188,5/27/2005 10:13:08 AM,Unknown (100)ALERT, REMOTE_REQUESTED_SHUTDOWN, Error Code: (600)(0)		

			1117203189,5/27/2005 10:13:09 AM,SD Ref Cool (104)EVENT, SHUTDOWN_EVENT, Error Code: (1001)(0)		
			1117203340,5/27/2005 10:15:40 AM,Power Down (200)ALERT, REMOTE_REQUESTED_ESTOP, Error Code: (601)(0)		
			1117203947,5/27/2005 10:25:47 AM,Reformer Purge (31)EVENT, STARTUP_EVENT, Error Code: (1000)(0)		
Butala	5/28/2005	245	Cards seated properly. Changed out four middle stack cards. Made no difference. Changed out desulfur can.		6
Butala	5/31/2005	245			
			Performed various electrical testing/estop circuitry w/ Plug Power's Paul Olsen on the phone. No success. Possible bad PDB or SARC.		6
			Changed out stack.		6
			Replaced batteries. Started unit, unit shut down on Levs5 low.		2
			Checked wiring, all wiring is correct, sending/receiving data but no data show up on enerview.		7
			Checked DI water flow and inlet pressure. Adjusted pressure from 40 psi to max available 48psi. Restarted unit. Unit again shut down on LEVS5 low.		2
			Replaced PDB. Did not correct the problem.		3
			Performed various electrical testing w/ George Collard on the phone. No success. Possible bad PDB or SARC.		2

LOGANEnergy Corp.					
Monthly Site Report					
Period	June-05				
Site	Kaneohe Bay				
Engineer	**Date**	**PP S/N**	**Activity**	**Mileage**	**Hours**
Butala	6/3/2005	245	Cards seated properly. Checked all cell voltages. No cells are too high or too low. Updated stack, fuel, KW, lifetime run in stats.		2
Butala	6/4/2005	245	1117865964,6/4/2005 2:19:24 AM,Running (51)ALERT, LOW_CELL_TRIP_ALERT, Error Code: (500)(0)		
Butala	6/6/2005	245	Changed master scanner card. Restarted system. All stack cells are now within correct range. Attempted to upload SARC 1.12.1 but didn't have Winzip on laptop.		2
Butala	6/8/2005	245			
			1118237976,6/8/2005 9:39:36 AM,ESTOP (107)EVENT, SHUTDOWN_EVENT, Error Code: (1001)(0)		
			1118237976,6/8/2005 9:39:36 AM,ESTOP (107)EVENT, SHUTDOWN_EVENT, Error Code: (1001)(0)		
			1118237985,6/8/2005 9:39:45 AM,ESTOP (107)ESTOP, HW_ESTOP_SARC_L0, Error Code: (534)(0)		
Butala	6/9/2005	245	Changed master scanner card. Restarted system. All stack cells are now within correct range. Attempted to upload SARC 1.12.1 but didn't have WinZip on laptop.		2

LOGANEnergy Corp.					
Monthly Site Report					
Period	July-05				
Site	Kaneohe Bay				
Engineer	**Date**	**PP S/N**	**Activity**	**Mileage**	**Hours**
Butala	7/8/2005	245	Updated lifetime stats.		1
Butala	7/31/2005	245	Checked unit on site - running. Checked remotely - running (first time I was able to get remote comms since 7/11/05).		1

LOGANEnergy Corp.					
Monthly Site Report					
Period	September-05				
Site	Kaneohe Bay				
Engineer	**Date**	**PP S/N**	**Activity**	**Mileage**	**Hours**
Butala	9/1/2005	245			
			Tried to reset SARC by unplugging "B" Plug. Unit was running but after pulling "B" Plug couldn't get interface and thus could not restart.		2
			Was able to get comms, started unit. Could not get comms remotely.		2
			Checked batteries - good. Restarted system. System shut down later that day on LEVS 5 Low.		1
			Restarted system.		1
			Checked DI water at unit - too low of flow. Changed out water panel filters- Charcoal, R/O, and Mixed Bed. Started unit. Modem test passed.		3